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Texas Water Resources Institute
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Evolution of Irrigation Districts and Operating Institutions: Texas, Lower Rio Grande Valley

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Evolution of Irrigation Districts and Operating Institutions: Texas, Lower Rio Grande Valley

Abstract

The growing population in the Texas Lower Rio Grande Valley, shortfalls in water deliveries from Mexico, and multiple years of drought have placed an increased need for efficient water management and allocation in the Rio Grande Basin. These improvements are essential regardless of the treaty compliance issues between Mexico and the U.S. for improved water deliveries to satisfy the 1944 Water Treaty. This report presents a broad overview of how the history of settlement and development shaped current water rights and laws, how the waters of the Rio Grande are divided between the two nations, and how the U.S. and the State of Texas manage their portions. Legal rules and regulations, both current and past, represent the complexity of water allocated in the region. The paper overviews characteristics of the 1944 International Water Treaty and management of Amistad and Falcon international reservoirs by the International Boundary and Water Commission. This overview provides insight on history and the basics of the current set of water allocations, rules and regulations, and some discussion of evolving institutions, i.e., water authorities. Knowledge of the background of the region facilitates ongoing water management policy deliberations, revision/development of policies, and future management of limited water resources. A review of selected Rio Grande Basin irrigation districts and associated operating principles will follow in subsequent reports.

Chapter 1
Background

The Rio Grande[1] serves as a border between two countries and serves millions of people along its flow to the Gulf of Mexico. Before the Rio Grande reaches the Gulf of Mexico, it passes along an area in the southernmost tip of Texas called the Lower Rio Grande Valley, or simply ***the Valley.***[2] The Valley represents a highly-productive agricultural community and region of rapid population and industrial growth. The Valley is home to 1.26 million people and is projected to increase to 3.05 million by the year 2050 (Rio Grande Regional Planning Water Group).

With the rapid increase in international trade and economic development, the region is a magnate for people. Serious issues related to water supply and allocations have been realized with this growth. The water issue must be addressed, however, under the constraints of the current operations of water supply entities, laws, and agreements.

This chapter describes the river, the history of settlement, and the history of development in the region. The first section briefly introduces the Rio Grande, describing the river's course, drainage, tributaries on both the Mexico and **U.S.**[3] sides of the river, and the reservoirs. The second section focuses on the history of settlement dating from the defeat of the Aztec Empire and succession to Spanish and Mexican rule. The third section examines the history of development of the Valley, starting in the late 1800s, through the railroad arrivals and land developers of the 1900s, up to the present 1.26 million population.

[1] The Rio Grande is known as the Rio Bravo in Mexico, both referring to the river dividing the U.S. and Mexico.

[2] All first mentioned ***bold, italicized*** terms in text are defined in the "Glossary," pp. 43-45.

[3] All first mentioned acronyms in the text are printed in **bold** and listed in the "List of Acronyms," pp. 46-47.

The Rio Grande

The Rio Grande (Figure 1) originates in southern Colorado, flowing approximately 600 miles south through New Mexico to the City of El Paso, Texas (U.S. Section, IBWC 2002). From El Paso, the Rio Grande serves as the 1,200 mile boundary between the U.S. and the Republic of Mexico, with four Mexican States (i.e., Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas) having the river in common with the State of Texas. The Rio Grande is the fifth largest river in North America and the longest river border between two countries in the world (Schmandt).

The entire Rio Grande Basin (**RGB**) drains an area of 335,000 square (**sq**.) **miles**, yet only about one-half of that area yields ***run-off*** to the River due to the presence of non-contributing areas of internally closed sub-basins (176,000 sq. miles). Of the total RGB drainage, approximately 89,000 sq. miles drain from the U.S. side, and approximately 87,000 sq. miles drain from the Mexico side (U.S. Section, IBWC 2000).

Two rivers, the Pecos and Devils Rivers, are the principal tributaries of the Rio Grande in Texas (see Figure 2), with both joining the Rio Grande above the Amistad Reservoir near Del Rio, Texas (or about 600 river miles from the mouth at Brownsville). The larger of the two rivers, the Pecos, drains more than 35,000 sq. miles. The Devils River only contributes about 340 sq. miles of drainage to the Rio Grande. The remainder of the drainage area in the U.S. is located in Colorado and New Mexico. Drainage for the upper RGB and construction of reservoirs have resulted in no Rio Grande flows beyond Fort Quitman, south of El Paso, Texas. This means the water supply for the Lower Rio Grande Valley primarily originates in the Mexican drainage area.

The three larger tributaries in Mexico that feed the Rio Grande include: the Rio Conchos, Rio Salado, and Rio San Juan. The Rio Conchos drains over 26,000 sq. miles in the States of Chihuahua and Durango and flows into the Rio Grande near Presidio, Texas (about 350 river miles upstream from the Amistad Reservoir). The Rio Salado drains portions of Coahuila and Nuevo Leon (drainage area of 23,000 sq. miles) and flows directly into Falcon Reservoir. The remaining major Mexican tributary, the Rio San Juan, enters the Rio Grande approximately 36 river miles below Falcon Dam near Rio Grande City, Texas (Rio Grande Regional Water Planning Group).

FIGURE 1. Graphic Location of the Rio Grande Basin.

Source: U.S. Section, IBWC 2002.

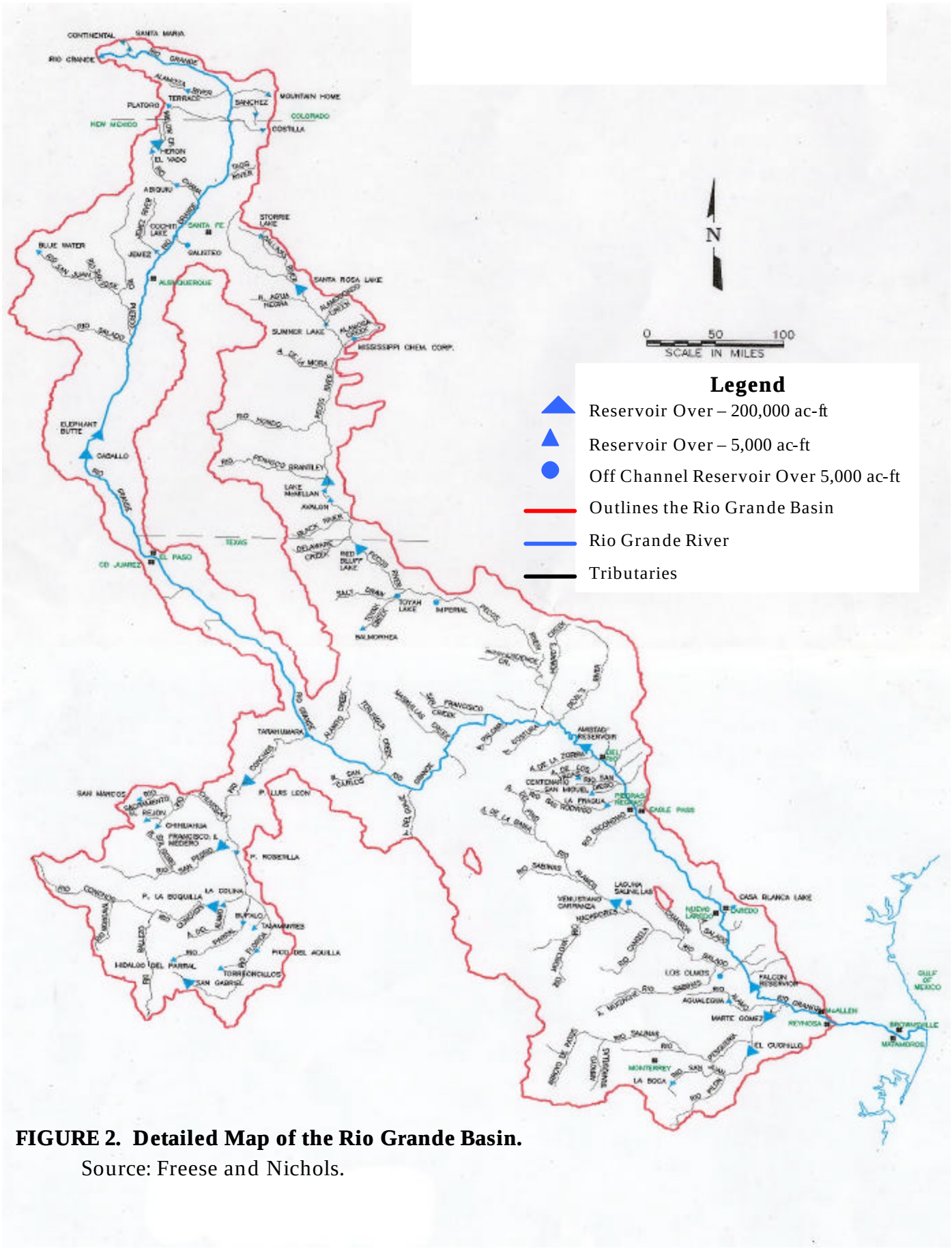

FIGURE 2. Detailed Map of the Rio Grande Basin.

Source: Freese and Nichols.

The two international reservoirs (Falcon and Amistad) along the U.S.-Mexico border and the two channel-diversion dams (Anzalduas and Retamal) in Mexico are operated as a system by the International Boundary and Water Commission (**IBWC**). Management objectives include regulating stream flows, providing flood control, generating hydroelectric power, and delivering water to the water rights holders in the region. Construction of Amistad Dam, near Del Rio, Texas, was completed in 1969. Falcon Dam, completed in 1953, is located 86 miles downstream from the sister cities of Laredo, Texas and Nuevo Laredo, Tamaulipas. The two international reservoir-systems have a combined conservation capacity of 5.7 ***million acre-feet*** (**maf**) (refer to Table 1). An additional storage capacity of 2.1 maf below the top of the spillway gates in the two reservoirs is used for flood control (Lower Rio Grande Valley Development Council).

Mexico has constructed numerous dams on the rivers noted above, as well as on their respective tributaries, to address their water needs for both agriculture and cities. Red Bluff Reservoir, near Pecos, Texas, is the only major reservoir within Texas on the Pecos. Table 2 is a summary of the characteristics for Mexico and U.S. tributary reservoirs.

Table 1. Holding Capacity of the Rio Grande International Reservoirs.

Reservoir	Year Opened	Total Conservation Capacity (1,000 ac-ft)	Total Percentage of Storage[a]	Percentage of Total International Reservoirs
Amistad	1969	3,081	35.55%	53.90%
Falcon	1953	2,635	22.94%	46.10%
Total		**5,716**	**58.49%**	**100%**

Source: International Boundary and Water Commission 2003.

[a] Based on the total conservation capacity. Current as of April 19, 2003.

Table 2. Holding Capacity of Rio Grande / Rio Bravo Tributary Reservoirs, 2003.

Stream / Reservoir	State	Year Opened	Capacity (1,000 ac-ft)	Percentage of Total
Mexico Tributary Reservoirs				
Rio Conchos				
– La Boquilla	Chihuahua	1916	2,353	36.7%
– San Gabriel	Durango	1981	207	3.2%
– Francisco I. Madero	Chihuahua	1949	282	4.4%
– Luis L. Leon	Chihuahua	1968	273	4.3%
San Juan				
– Marte R. Gomez	Tamaulipas	1943	810	12.6%
– El Cuchillo	Nuevo Leon	1993	910	14.2%
Rio Salado				
– Venustiano Carranza	Coahuila	1930	1,122	17.5%
Other Mexico Streams				
– 6 minor reservoirs[a]	n/a	n/a	141	2.2%
Sub-total for Mexico[b]			**6,099**	**95.2%**
United States Tributary Reservoir				
Pecos				
– Red Bluff	Texas	1953	307	4.8%
Sub-total for Texas			**307**	**4.8%**
Total Rio Grande / Rio Bravo Tributary Reservoirs:			**6,406**	**100.0%**

Source: Wurbs; Rubinstein 2003.

[a] The largest of these reservoirs has a capacity of approximately 41,000 acre-feet (**ac-ft**).

[b] Within the Rio Grande Basin boundary.

History of Early Settlement

Historically, ownership of land and water in the Lower Rio Grande Valley of Texas is jointly related. In 1521, after Hernan Cortez defeated the Aztecs, the Spanish began dividing and distributing the spoils of victory. The Spanish process for granting land was an extended bureaucratic one. As settlers moved north from Central Mexico, land grant sizes grew as water became scarcer. The

land not attached to water was less valuable, and few settlers held land titles. It soon became obvious that land values were tied to water availability. Therefore, by the mid-sixteenth century, agriculture land titles began specifying irrigation and water rights (Teja). The large number of violations (i.e., non-title holders farming/ranching and living on Spanish land) was cause for attempts to reform the "granting" system. Even though the word "grant" was used, all title transfers from the Crown to private landowners were sales. In 1802, the Junta Superior de Real Hacienda (Head of Real Estate) attached land prices to water availability, resulting in irrigable land being the most expensive and pasture/rangeland being the least expensive (Teja).

In the sixteenth and seventeenth centuries, few expeditions explored the region of South Texas, including the Lower Rio Grande Valley, due to the lack of interest in settlement. Those who did, such as LaSalle at Matagorda Bay in 1685, did not return to Spanish authorities with praises for the region. The area between the Nueces River and the Rio Grande was quickly regarded as unmanageable and not fit for settlement. In 1747, Capt. Joaquin de Orobio Basterra led an expedition to South Texas to search for possible colonization sites. Upon his return, he reported that not only did the Nueces not flow into the Rio Grande as suspected, but also there was "no place suitable for settlement from the area of the Nueces River to the Rio Grande, essentially because of the great absence of fresh water" (Teja). Many others entered South Texas and made similar conclusions. The only hope for the land seemed to be irrigation, but that possibility was disregarded due to the vast and harsh surroundings. The hot and dry climate, combined with limited water and hostile Native Americans, made this area not highly desirable for settlement for many decades (Teja).

Early Water Resource Development

Water resources in the Lower Rio Grande Valley therefore limited settlement to a ranching economy. It should be noted, however, that between 1740 and 1840, the Spanish/Mexican ranch settlements in the Valley were expanding in population, expanding in production/export of livestock, and were relatively successful, *vis. a vis.* a frontier ranching economy (Alonzo). This Hispanic economy suffered, however, from depopulation following the political upheaval of the Texas Revolution and the U.S.-Mexican War. By the late 1800s, the Lower Rio Grande Valley was again sparsely populated, with the number of cattle outnumbering people. The few settlements that survived were missions and

military outposts established along the Rio Grande. The King and Kenedy ranches were two of many large cattle operations north of the Rio Grande that thrived on the basic ranching practices used by the *vaqueros* (Mexican cowboys), allowing such operations to survive and prosper in the arid climate. Due to the rugged terrain, this area attracted mostly former military men and land developers from the 1860s to the 1900s (Dillman). Northern U.S. land developers began to move into the Rio Grande Valley area in the latter part of the nineteenth century. This land grab of cheap, undeveloped real estate is said to have been the principal precipitant of the rapid agriculture growth in the area (Dillman).

John Closner created one of the first irrigation networks in the Rio Grande Valley during 1895 to irrigate his sugar plantation, but his venture ultimately failed due to financial problems (Tiefenbacher). Closner's venture was the first of many irrigation companies created to accommodate the interest in irrigated agriculture. In the 1890s, land developers began digging irrigation canals and removing brush vegetation, thereby transforming the landscape into an "agriculture oasis" (Dillman). Mexican immigrants performed the grueling manual tasks of creating these enormous projects. Irrigation and land companies were in abundance until 1915-1920 when financial difficulties caused buyouts and consolidations. According to Tiefenbacher, farmers organized irrigation districts (**IDs**) and bought out the developers in order to insure future water supplies. By 1920, there were only four privately-owned irrigation companies remaining (Stambaugh and Stambaugh).

As irrigated agriculture grew in the Valley, it was constrained by the lack of labor and infrastructure. The labor issue was solved by massive immigration of Mexican refugees escaping the violence of the Mexican revolution. The infrastructure problem was solved with the extension of the railroad. The extension of the St. Louis, Brownsville, and Mexico Railroad (**SLB&M**) sparked the beginning of a population and infrastructure boom in the Valley. Before the railroad's arrival in 1904, Brownsville was the only notable town on the Texas side of the border, and Reynosa and Matamoros were the only towns of notable size on the Mexican side (Dillman). In July 1904, after eleven months of construction, the railroad finally reached from Corpus Christi to Brownsville (Kearney). Many of the smaller towns occupying the Valley today were established in the same year the railroad reached that area, including Raymondville, Harlingen, San Benito, Weslaco, and McAllen. As the railroad moved south, people followed, and where people went, water companies and developers followed.

Major development companies were formed and owned by only a few people: Uriah Lott, Leonidas C. Hill, Sr., John McAllen, John J. Young, Ed C. Couch, Dan R. Couch, R. C. Couch, R. L. Reeves, and W. E. Stewart. These entrepreneurs were interested in developing land through farming rather than in traditional Hispanic ranching (Stambaugh and Stambaugh).

Raymondville was established by the Raymond Town and Improvement Company in 1904, the same year that the railroad reached the town (Addington). In 1910, Leonidas C. Hill envisioned the Arroyo Colorado as a commercial waterway and established Harlingen (Gilbert). In 1907, the San Benito Land and Water Company began dividing and selling lots, and San Benito was chartered in 1911 (C. Robinson). An extension of the SLB&M railroad reached Weslaco in 1904. During the same time, the American Rio Grande Land and Irrigation Company began purchasing land in that area. In 1917, the land was sold to the W. E. Stewart Land Company, hence the name W.E.S.La.Co. The town was platted in 1919 (Garza 2002a). The extension of the SLB&M railroad reached McAllen in August 1904, and the McAllen Township Company was formed (Garza 2002b).

The agriculture boom had begun. Not only was the railroad taking commodities out of the Valley to urban centers, but it also was bringing people to the Valley. By 1920, vegetables, cotton and citrus began to take hold as dominate crops in the area, and the population almost doubled (Tiefenbacher). Refugees from the Mexican Revolution in Mexico, combined with Anglo-Americans from the North, created the largest population boom the Valley ever experienced. Developers used promotional techniques to lure settlers from the North and Mid-Western parts of the U.S. (Dillman). Promises of rich agricultural land and a growing population brought an enthusiasm to the Valley. The fast influx of people to the Valley caused residential water supplies to lag behind that of the established irrigation networks. According to Tiefenbacher, San Benito used tank cars to transport water to the town in 1907, and later switched to irrigation canals. In 1914 and 1915, McAllen and Mission used windmill pumps to divert water from the river to water towers. Virtually all of the water at that time was untreated and obtained directly from the Rio Grande.

It was not until the Depression of the 1930s that water-borne shipping began to affect the area. In 1936, the Port of Brownsville was opened, providing easier access to New Orleans, the Mississippi River, and Northern markets (Tiefenbacher). By World War II, the Valley was swept up in industrialization, gas and oil transports, and shipping.

According to Tiefenbacher, the Rio Grande overflowed 23 times between 1900 and 1939, with hurricanes hitting the area in 1910, 1913, and 1933. This unusual increase in rainfall set in motion a string of flood-control projects by the IBWC. "By 1950, it had planned and completed 75 percent of these projects, including Falcon Dam, 145 miles of ***floodways***, and 285 miles of ***levees*** along the river channels and floodways" (Tiefenbacher). In 1944, the U.S. signed the Water Treaty with Mexico.[4] Shortly after the treaty was signed, in the early 1950s, the worst drought in recorded history hit South Texas. Currently, South Texas is in another extended drought period (Taylor 2002a). Difficulties with compliance of the 1944 Water Treaty by Mexico are the cause of much contemporary controversy in the Valley[5] (Taylor 2002a).

Currently, the Rio Grande Valley is thriving as one of the fastest growing areas of Texas due to its relatively young population and its proximity to a large manufacturing base in Northern Mexico (Schmandt). This rapid population growth puts emphasis on the availability and demand for water. Population projections (Schmandt) predict an even greater demand of water, as population in the Lower Rio Grande Valley (the U.S. side only) is expected to reach 3.05 million by 2050, which is almost two and a half times the current population of 1.26 million (Rio Grande Regional Water Planning Group). History shows that this area's population doubles approximately every 20 years, with an average annual growth rate of 1.8 percent anticipated during the next 50-year time period (Rio Grande Regional Water Planning Group).

Chapter Summary

This chapter has shown how an area that was once found to be undesirable by some was turned into a strong community, building on land development and irrigation. Through settlement and development, the Valley has become a strong agricultural force and recently diversified to include manufacturing and tourism. Despite large amounts of urbanization and industrialization, 75 percent of the total land area is still used for agriculture and livestock (Rio Grande Regional Water Planning Group).

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[4] The Treaty set rules for establishing water allocations along the border and is discussed in more detail subsequently in this paper. It is formally titled, "U.S.-Mexico Treaty for Utilization of the Waters of the Colorado and Tijuana Rivers and of the Rio Grande," but commonly referred to as the "1944 Water Treaty."

[5] Issues relating to compliance with the 1944 Water Treaty are discussed in more detail within the "Emerging Issues" chapter, i.e., Chapter 4.

Chapter 2

Water Rights

Water in the Valley (as well as across all of Texas and the world) is a finite and precious resource. Texas has a long history of conflict over water, many associated with the former nations that possessed Texas. Laws and rights to water are the results of past legal battles, legislation, and international contracts. Long, extended court trials, civil suits, and legislative debates have brought about a unique system of dividing surface water in Texas, particularly in the Valley.

This chapter looks at the history of water rights, the establishment of irrigation districts, and recent water right history. The first section examines the three main stages that water law has taken in Texas history: the early riparian Spanish/Mexican laws, the complicated "***dual system***," and the present State licensing. The second section describes the formation of the water districts located in Texas. These districts play a key role in water management and operations in the Lower Rio Grande Valley for agricultural, urban, and industrial users. The third section presents a more recent view of Texas water laws. It summarizes the famous lawsuit, *State of Texas v. Hidalgo County Water Control and Improvement District No. 18* (1969), and the impact it has in current water operations in the Valley.

Abridged History of Water Rights in Texas

The history of surface-water laws in Texas is lengthy and perplexing. To date, the State of Texas has used three different forms of water law: riparian (1840-1889/95), the "dual system" (1889/95-1967), and State licensing (1967-present) (Baade). The current Texas water rights system was formed in a unique and complex manner over almost 200 years. Figure 3 is an outline of key historical events regarding Texas water law as it pertains to the Lower Rio Grande Valley.

Many of the Spanish/Mexican water laws were unchanged from 1821 to 1840. There was a misinterpretation of Spanish/Mexican water laws, however, for many years. Specifically, landowners within Texas assumed that Spanish land

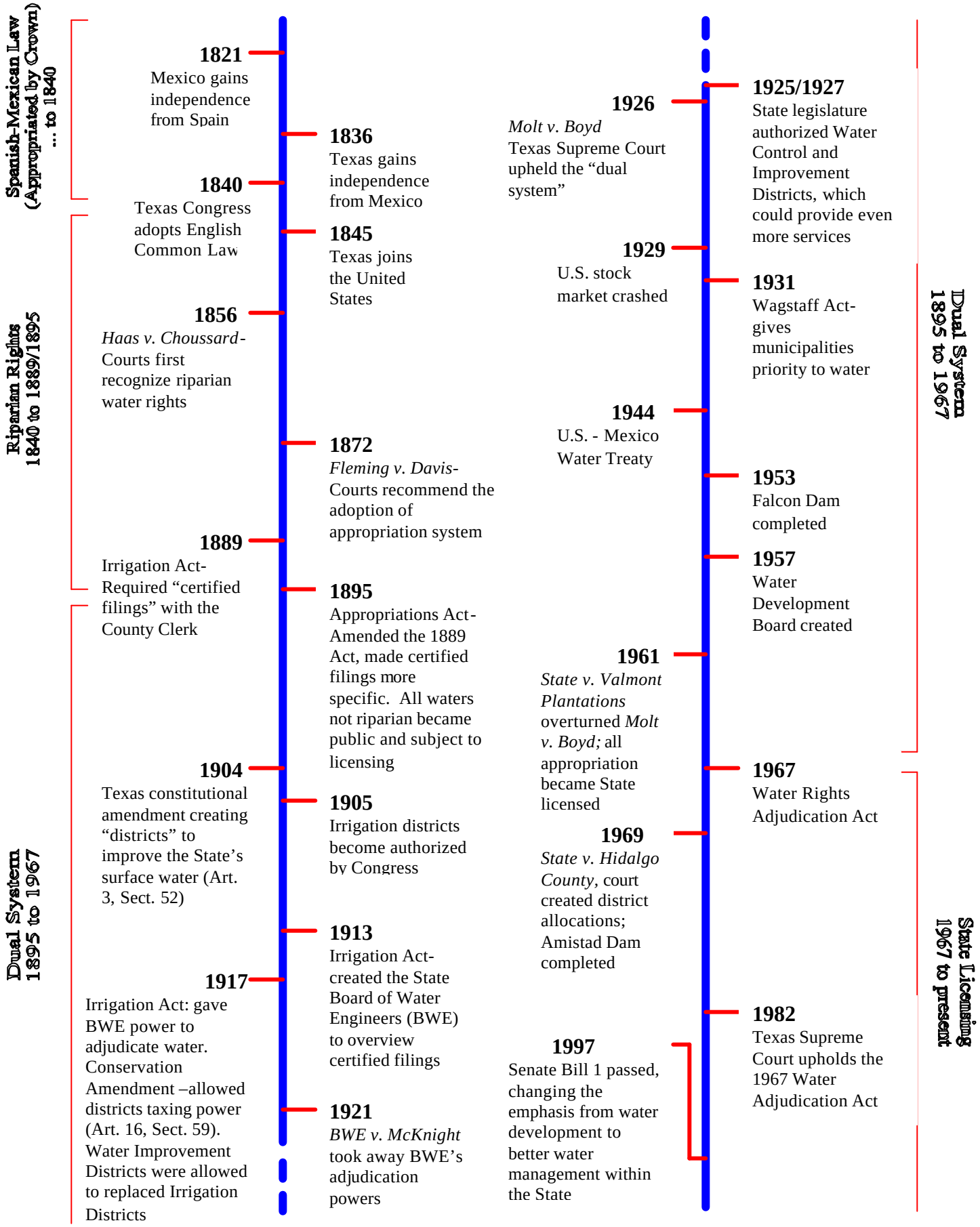

FIGURE 3. History of the Development of Texas Water Law as it Pertains to the Lower Rio Grande Valley (1821 – 1997).

Source of Contents: Baade; Kaiser; Smith, G.; State of Texas; and Strambaugh.

grants also held ***riparian water rights***, which allows landowners adjacent to surface water rights to that water. This type of ownership was only confirmed after Texas gained its independence from Mexico in 1836, and the Texas Congress adopted a form of ***English Common Law*** (1840). Under Common Law, riparian landowners could "make reasonable use of water for irrigation or for other purposes" (Templer). The first recorded case of the courts upholding the riparian system is *Haas v. Choussard* in 1856 (17 Tex. 588) (Baade). The judge held that the "right to the use of the water adjacent to [one's] lots, as it flowed in the natural channel [was] a right inherent to and inseparably connected with the land itself" (Baade). In 1868, the courts ruled again on riparian water rights as it applied to irrigation. It soon became apparent that for some of the more arid portions of the State with finite water supplies, this riparian rule would drain these areas. After the 1872 case of *Fleming v. Davis* (37 Tex. 173), the courts recommended the legislature adopt the appropriation system (Baade), which means the State approves permits for a specific amount of water to a user from a specific source. This recommendation went unheard, however, until the Irrigation Act of 1889.

All land acquired from the State after 1895 holds no riparian water rights and must be appropriated though current state procedures (Templer). This half-and-half system is what Baade calls a "Dual System." The overall problem with the dual system was over-appropriation, because water is a limited resource that can be overdrawn.

In 1889, the Irrigation Act was passed, requiring surface-water users to file an affidavit with the County Clerk within the county where they intended to divert water. These affidavits were called "certified filings" and were on a first-come-first-served basis. Those individuals who filed claims first held the first rights to available water. Conversely, those individuals who were late to file suffered the most in the effects of over-appropriation. The numerous overlapping certified filings meant that no water right claim was safe. This problem was not clearly addressed until the 1913 Irrigation Act.

Another problem with the 1889 Act was that it actually protected irrigation ditch companies by leaving them unregulated (Baade). Irrigation companies became regulated in the 1895 Appropriations Act, but the issue of appropriation of water was not addressed.

In 1913, the Irrigation Act created the Board of Water Engineers (**BWE**) as well as statutes requiring a formal process of surface water appropriation. The BWE was given power to ***adjudicate*** water rights in the 1917 Irrigation Act. All

waters owned by the State had to be appropriated through permits by the Board (Baade). The BWE's power of appropriation was cut short by the Texas Supreme Court ruling in *State Board of Water Engineers v. McKnight* (111 Tex. 82; 1921) (Baade). The Court ruled this part of the 1917 Irrigation Act unconstitutional, based on violating separation of powers; i.e., an executive agency cannot hold judicial powers. The Texas Supreme Court upheld the dual system in *Molt v. Boyd* (116 Tex. 82; 1926), by still allowing riparian water rights to coincide with State appropriation rights (Baade).

The dual system was not intensely reviewed again until the 1950s, beginning with the building of the Falcon Reservoir (Templer). The courts reevaluated the Spanish/Mexican law, which was thought to be riparian, in the landmark case *State v. Valmont Plantations* (346 S.W.2d 853; 1961). It was concluded that all Spanish and Mexican grants resulting from transferring public property to private ownership had to emanate from the Crown, including water rights (Teja). *Valmont* overturned *Boyd* and "held that the Spanish/Mexican irrigation system prevailing in trans-Nueces Texas (area between the Nueces River and the Rio Grande) until the introduction of the Common Law had *not* been riparian in nature" (Baade). This legal finding stripped Spanish land grant holders of their riparian water rights, leading to the change from a dual system to that of State licensing.

The Water Rights Adjudication Act was passed in 1967 in an attempt to create an administrative and judicial system for dealing with water rights. This act was intended to prevent massive lawsuits, such as the *State v. Hidalgo County Water Control and Improvement District No. 18* (443 S.W.2d 728; 1969). Currently, all applications for water appropriation of any Texas stream are made to the Texas Commission on Environmental Quality (**TCEQ**) and are subject to judicial review[6] (Templer).

History of Lower Rio Grande Valley Water Districts

There are many different special water districts that provide a wide variety of services in Texas, e.g., sewage, drainage, and irrigation. In 1904, a constitutional amendment (Art.3, Sect. 52) allowing public development of the State's water resources, namely surface water, paved the way for the numerous

[6] This application process is discussed in more detail in the "Recent History of the Water Rights System" section, following the next section.

different types of districts. Each district provides a set of services, which are identified when the district is formed. The type(s) of such services may vary from district to district. Some of these services overlap with those of other special districts. For the purpose of this report, only those districts that provide irrigation services are considered, i.e., Irrigation Districts (IDs); Water Improvement Districts (**WID**s); and Water Control Improvement Districts (**WCID**s).

Land developers focusing on selling fertile and irrigable land ready for planting had an incentive to form irrigation and canal companies in the early part of the 1900s. When the majority of the land was sold, many of the irrigation companies no longer had the incentive to properly maintain irrigation networks. Farmers did have the incentive, however, and they began organizing IDs, WIDs, and WCIDs, and purchasing water rights held by irrigation and land companies (Strambaugh).

After the 1929 stock market crash, even the largest irrigation company, the American Rio Grande Land and Irrigation Company, was forced to sell out to the farmer-organized Hidalgo & Cameron Counties Water Control and Improvement District No.9, in 1930 (G. Smith). During this same time period, farmers organized and purchased the remaining privately-owned companies. The sole exception was the Union Irrigation Company of Mission, Texas, which lasted until World War II, when it was sold out to the Hidalgo County Water Control and Improvement District No. 1 & 7 (G. Smith).

By purchasing these private companies, IDs and WCIDs were obtaining all of the water rights, which ranged in type from riparian, to certified filing, to BWE certified, to even old Spanish rights. Because bankruptcy was the cause of many company failures, farmers were able to purchase the existing companies for pennies on the dollar. Owners held no bargaining power and creditors saw it as a way to retrieve some of their losses (G. Smith).

Under the 1904 amendment, IDs provided limited services, including irrigation, drainage, flood control, and wholesale water and untreated water supply (Texas Commission on Environmental Quality 2002). The first IDs, authorized by the Texas Legislature in 1905, were allowed to encompass one or more counties and were required to be overseen by a five-person elected board. Cities and towns could be included in IDs. Under the 1904 amendment, districts could issue bonds up to one-fourth of the property value with a two-thirds vote of qualified tax-paying voters. The 1905 law was replaced in 1913 with the Irrigation Act, which stated a district could be established by a two-thirds vote of qualified

tax-paying voters after an examination by the County Commissioner (Jasinski). The ID also held the right of ***eminent domain***.

In 1917, under the Conservation Amendment, WIDs were authorized by the State Legislature and allowed to replace IDs. WIDs did not include towns or cities unless requested and required a majority vote and approval by the BWE. Under the 1917 Conservation Amendment, WIDs, with majority vote, could issue bonds without limit on an ***ad valorem*** or specific-benefit basis (D. Smith 2002b).

Many WIDs converted to Water Control Improvement Districts (WCID) in 1925, which were authorized by the Legislature in 1925 and 1927. WCIDs' powers are broader than these of IDs and WIDs, as they can tax the local public based on ad valorem or specific-benefit bases or both (D. Smith 2002a).

In 1926, in *Molt v. Boyd*, the Texas Supreme Court upheld riparian water rights, causing riparian water-right holders to take little notice of the formation of IDs, WIDs, and WCIDs because their rights were secured to their land. After the irrigated lands were purchased during the Great Depression at low prices, developers sought out pasture land at a low cost. After clearing and developing the properties, developers organized WCIDs that could raise bonds for irrigation improvements, and effectively pass the costs to farmers/growers. The old, unabolished, certified-filing system proved to be the loophole for developers who possessed no water rights (G. Smith). Under the 1913 Irrigation Act, all that was required was to obtain a permit from the BWE. The BWE did not have the power to deny a certified filing because of *McKnight* (1921). This process did not require any notification to the current irrigators. Not surprisingly, the issue of over-appropriation was exacerbated while making developers wealthy.

Recent History of the Water Rights System

The U.S. share of inflows in the Lower Rio Grande and storage in Amistad and Falcon reservoirs is allocated to irrigators, cities, and other water users in accordance with the *Texas Water Code, Chapter 303* (Texas Commission on Environmental Quality 2000). There are essentially two different surface water rights systems in the State, the first applying only to the Lower and Middle Rio Grande below Amistad Dam, and the second applying to the remainder of Texas, including the Rio Grande above Amistad Dam.

The Texas share of the Rio Grande water flow below Falcon Dam was allocated among numerous water rights holders in conjunction with the landmark lawsuit, *State of Texas v. Hidalgo County Water Control and Improvement District No. 18* (1969), commonly called the "Lower Rio Grande Valley Water Suit." The lawsuit was filed in 1956, with the trial held in 1964-1966, and the final judgment of the appellate court filed in 1969. The litigants in the Rio Grande lawsuit included 42 water districts and 2,500 individuals, with more than 90 lawyers appearing before the court. The expense and effort involved in the process demonstrated the impracticality of a purely judicial determination of water rights for the entire state. The resulting enactment of the Water Rights Adjudication Act of 1967 established much of the existing surface water rights system for the remainder of Texas.

Several categories of rights were designated through the system established by the Lower Rio Grande Valley Water Suit. Domestic, Municipal, and Industrial (**DMI**) rights have the highest priority in the allocation procedures, with irrigation rights holding a residual claim on inflows to the reservoirs. Minor amounts of water for livestock and mining were also designated. Two classes of irrigation water rights were established (i.e., *Class A* and *Class B)*. Class A water rights went to individuals and institutions that had a proven water right (i.e., riparian, prior appropriation, or Spanish/Mexican land grant). Class B water rights were assigned to individuals and institutions who could prove a "history of diversion" from the Rio Grande. These rights were determined as part of the Lower Rio Grande Valley Water Suit, ruled by Judge Starley (Houston Advanced Research Center & Instituto Tecnilogico de Estudios Sueriores de Monterrey). Historical cropped acreages were used to assign those rights, and of the 742,809 acres of agricultural land in the Lower Rio Grande Valley deemed eligible, 641,221 acres were assigned Class A irrigation rights. The remaining 101,588 acres were assigned Class B irrigation rights. Class A rights accrue water in storage at a rate 1.7 times greater than Class B rights. This weighted-priority system for irrigators distributes water in water-short years among all irrigators, with Class A rights receiving larger allocations than Class B rights. The priority system has little significance in years with sufficient water to meet all permitted diversion amounts since water is not scarce.

Currently, there are twenty-nine different irrigation districts within the Lower Rio Grande Valley that provide irrigation as well as municipal supplies.

Table 3 depicts levels of water rights for twenty-four of the twenty-nine districts, as of January 2003.[7]

Irrigation rights may be purchased and converted to municipal rights, although a 2-to-1 conversion is required, i.e., two ac-ft of irrigation water rights must be purchased or released to obtain one ac-ft of municipal rights. This conversion is part of an effort to correct the over-appropriation of water in the region. That is, total rights granted in the historic court case of the *State of Texas v. Hidalgo County Water Control & Improvement District No. 18* exceed the sustainable amount of water which can reasonably be delivered over time. Over time, these rights will be reduced, therefore correcting the previously over-appropriated system.

Chapter Summary

This chapter reviewed a brief history of water issues in Texas. Ranging from a riparian system to the current state licensing system, Texas water rights have evolved into a unique approach in dividing surface water. During this evolution, water districts represent one of the institutions that have taken a major role. Twenty-nine water districts currently operate in the Valley. Many of the rules and regulations that these districts abide by were established in the Lower Rio Grande Valley Water Suit. The district operations are discussed further in the following chapter.

[7] Of the total twenty-nine districts that provide irrigation services, only twenty-four are presented in Table 3. The five irrigation districts not presented are limited in size and are not routinely listed in TCEQ/ Watermaster reporting of "District Allocations" (Rubinstein 2003).

Table 3. Lower Rio Grande Irrigation District Annual Allocations.

Official Irrigation District Title	Common District Title	Authorized Annual Water Right (ac-ft)	Percent of Total
Adams Garden Irrigation District #19	Adams Garden	18,737.65	1.34%
Bayview Irrigation District #11	Bayview	17,478.02	1.25%
Brownsville Irrigation District	Brownsville	33,949.45	2.42%
Delta Lake Irrigation District	Delta Lake	174,776.37	12.47%
Donna Irrigation District-Hidalgo County #1	Donna	94,063.60	6.71%
Hidalgo County Irrigation District #1	Edinburg	85,615.00	6.11%
Engleman Irrigation District	Engleman	20,031.30	1.43%
Harlingen Irrigation District-Cameron County #1	Harlingen	97,513.70	6.96%
Hidalgo County Irrigation District #13	HCID #13	4,856.85	0.35%
Hidalgo County Irrigation District #5	Progresso	14,234.62	1.02%
Hidalgo County Irrigation District #6	Mission #6	34,913.00	2.49%
Hidalgo County Water Control & Improvement District #18	HCWC&ID #18	5,505.15	0.39%
La Feria Irrigation District-Cameron County #3	La Feria #3	75,625.92	5.40%
Cameron County Irrigation District #6	Los Fresnos	52,141.92	3.72%
Hidalgo County Water District	McAllen #3	9,752.60	0.70%
Hidalgo & Cameron Counties Irrigation District #9	Mercedes #9	177,151.62	12.64%
Hidalgo County Irrigation District #16	Mission #16	20,000.00	1.43%
Hidalgo County Water Control & Improvement District #19	Mission #19	11,776.65	0.84%
Cameron County Irrigation District #2	San Benito	147,823.65	10.55%
Hidalgo County Irrigation District #2	San Juan #2	137,675.00	9.82%
Santa Cruz Irrigation District #15	Santa Cruz #15	77,180.00	5.51%
Santa Maria Irrigation District-Cameron County #4	Santa Maria #4	10,182.50	0.73%
United Irrigation District of Hidalgo County	United	64,463.52	4.60%
Valley Acres Water District	Valley Acres	16,124.25	1.15%
Totals		**1,401,572.38**	**100%**

Source: Rubinstein 2003.

Chapter 3

International Boundary and Water Commission and Texas Commission on Environmental Quality Operations

Historical events have shaped the currently operating water institutions. Texas water policy experienced a long and extensive transformation before reaching the present process. The operating procedures used by the federal and state institutions in the Lower Rio Grande Valley are discussed within this chapter.[8]

It would be difficult and tedious to describe in detail the entire operating procedures; therefore, the following sections provide only a brief summary. The first section discusses the allocations of inflows for the U.S. side of the border. The steps followed by the Rio Grande ***Watermaster*** for allocating the U.S. share are presented. The second section reviews the key elements (articles 4 and 8) in the 1944 Water Treaty between the U.S. and Mexico. This treaty provides the basic rules of diverting water to and from the Rio Grande. The third section briefly illustrates the management practices of the two international reservoirs along the Rio Grande, Amistad and Falcon.

Allocation of Inflows

The IBWC reports the amount of usable water in storage in Amistad and Falcon Reservoirs allocated to the U.S. as of the last Saturday of each month, as determined in accordance with the 1944 Treaty between the U.S. and Mexico. ***Usable storage*** is defined as the amount of U.S. water in the conservation pools less ***dead storage*** currently estimated to be 4,600 ac-ft (Rio Grande Regional Water Planning Group). TCEQ's Rio Grande Watermaster oversees the interests of Texas water rights holders, allocates the Texas share of inflows to those parties, and maintains records of daily, weekly, and monthly diversions associated with all water rights. Approximately 1,600 water rights accounts exist for the Middle and Lower portions of the Texas Rio Grande (Rubinstein 2002). For a listing of the

[8] Reviews of selected Rio Grande Basin irrigation districts and associated operating principles will follow in subsequent reports.

storage balances during March 2000 to March 2003, refer to Table A1 in Appendix A.

The Watermaster performs computations each month to allocate the U.S.'s share of the storage in Amistad and Falcon Reservoirs. Each water right is limited by both its permitted ***annual diversion amount*** and the water available in storage to supply the diversion. Development of the allocation procedure dates back to the previously-mentioned Lower Rio Grande Valley Water Case of the 1950s and 1960s. The allocation procedure followed by the Watermaster is based on the following steps (Texas Commission on Environmental Quality 2000):

1. From the total amount of usable U.S. water stored in the Amistad and Falcon conservation pools, the first step consists of reserving 225,000 ac-ft for domestic, municipal, and industrial uses. This is called the ***DMI (domestic/municipal/industrial) reserve***. Domestic, municipal, and industrial uses are given highest priority by deducting the pool as the first step in the monthly reallocation. The pool acts like a buffer and is refilled each month to its level of 225,000 ac-ft, regardless of time of year or the balances within the accounts for the DMI users. This amount of water is therefore available at the beginning of each month and is considered as providing at least **M&I** (municipal & industrial) water needs for one year.

2. From the remaining water in storage, the total end-of-month account balances for all irrigation and mining rights are deducted.

3. Next, available water is allocated to an ***operating reserve*** to provide for loss of water by seepage and evaporation (adjustments required as the U.S.-Mexico water ownership computations are finalized each month) and emergency requirements. In March of 2001, this value was lowered significantly to 75,000 ac-ft. Prior to that time, the operating reserve varied in quantity between 275,000 ac-ft and 380,000 ac-ft, depending on the amount of water in storage. If the amount of water available was between 150,000 ac-ft and 275,000, that amount was allocated to the operating reserve. If the balance available for the operating reserve happened to fall below 150,000 ac-ft, however, deductions were made from the irrigation and mining accounts as necessary to provide 150,000 ac-ft for the operating reserve. This latter step was known as a negative allocation. Currently, the operating reserve is set at 75,000 ac-ft regardless of level of the reservoir, and negative allocations to the irrigation accounts may take place if the monthly inflows are inadequate to refill that reserve to its required level.

The operating reserve is flexible and can be allowed to drop to zero before negative allocations occur. It can also be noted that negative allocations have never occurred. This is one of the main reasons for lowering the reserve in 2001, from 275,000 ac-ft (Halbert). According to former Watermaster Carlos Rubinstein, decreasing the operating reserve in 2001, to 75,000 ac-ft, has led to more available allocated water than previously experienced under the 275,000 ac-ft rule. The change was made due to an analysis "in that a study of evaporation losses through time indicated the overprotective nature of the previous rule" (Rubinstein 2003).

4. Any remaining water in storage is allocated among all of the irrigation districts and others holding irrigation and mining rights. The storage is basically allocated in proportion to annual diversion rights, except the Class A rights are multiplied by a factor of 1.7 to allow them a greater storage allocation than Class B rights. Other provisions include limiting each storage allotment to not exceed more than 1.41 times its authorized diversion right; any remaining unallocated water is retained by the Watermaster. If an irrigation right does not use water for two consecutive years, its storage account is reduced to zero. It can be reactivated upon written request to the Watermaster. After ten years of inactivity, the right is subject to cancellation. Such cancellation processes are currently occurring for some holders of small amounts of water rights (Halbert).

Each municipal and industrial water-right holder has a permitted annual diversion amount, which is allocated to them at the beginning of the ***water year***.[9] Total annual use cannot exceed the permitted amount except in the case of so-called ***"no-charge" pumping*** which is allowed during periods of excess flow. The Watermaster may authorize such pumping periods to capture water which might otherwise be lost, often just after large storm events below Falcon Dam (Rubinstein 2002). Irrigation rights are administered slightly differently. Balances in irrigation accounts roll over from one year to the next, unlike the municipal/industrial/domestic accounts, which expire at the end of each water year.

In practice, holders of irrigation rights communicate their water needs directly to the TCEQ Rio Grande Watermaster's Office, with headquarters in Harlingen, Texas, which in turn requests release of U.S. water from the IBWC.

[9] A water year begins on the last Saturday of the year at midnight. This beginning date is not always January 1 (Hinojosa).

Such requests are made daily. Agricultural producers within IDs make their requests to their IDs, and the IDs make the accumulated request for the water to the Watermaster.

The Watermaster makes daily requests for releases from the reservoirs to the IBWC. In determining Falcon Reservoir releases for the Lower Valley, the Watermaster Office considers the quantities of water requested by all users and their diversion locations, potential channel losses and gains, watershed run-off and tributary inflows, channel and bank storage, waters stored by ***weirs***, and storage at Anzalduas Dam. Some water users near the coast are more than 200 river miles below Falcon Dam. Consequently, requests for releases must be made five to seven days in advance to allow time for water to flow to the location in which it is needed. To aid in scheduling water deliveries, the Rio Grande (from Falcon Dam downstream to the lowest gauge near the Gulf of Mexico) has been divided into seven ***reaches***, with each reach having a travel time of about one day. Travel time does not apply to small diverters (i.e., non-water districts). Immediately upon notification to the Watermaster, small diverters can begin diverting (Halbert). The IBWC provides the Watermaster information regarding flow rates at the various gauges along the river and estimates of the U.S.'s share of the river flows and water stored at Anzalduas Dam.

International Treaty Components

The IBWC, with representatives from both Mexico and the U.S., administers the two International Treaties governing use of the waters of the Rio Grande. The 1906 Treaty (Equitable Distribution of the Waters of the Rio Grande) provides for delivery to Mexico by the U.S. of 60,000 ac-ft annually in the El Paso-Juarez Valley upstream from Fort Quitman. Terms of the Treaty state that if shortages develop or occur in the supply of water originating above El Paso, then deliveries to Mexico are to be reduced in the same proportion as deliveries to the U.S. The 1906 Treaty also includes a provision stating that Mexico "waives any and all claims to the waters of the Rio Grande for any purpose whatever between the head of the present Mexican Canal and Fort Quitman, Texas."

This original agreement was augmented substantially by the Treaty of February 3, 1944 for the "Utilization of the Water of the Colorado and Tijuana Rivers and of the Rio Grande" (Treaty). The Treaty expanded the original International Boundary Commission to the current IBWC, authorized construction

and operation of the Amistad and Falcon projects by the IBWC, and provided for the rules governing distribution of the Colorado, Tijuana, and Rio Grande rivers (Wurbs). Articles 4 and 8 of the Treaty deal with allocation rules for the Rio Grande from Fort Quitman, Texas to the Gulf of Mexico. Appendix B contains a reproduction of this text.

The current IBWC, as it operates below the Falcon Reservoir, is primarily responsible for water accounting and maintenance between Anzalduas Dam and the Gulf of Mexico (Houston Advanced Research Center & Instituto Tecnilogico de Estudios Sueriores de Monterrey). The IBWC tracks the storage levels for each country based on the reserve allotment and maintains the water infrastructure along the Rio Grande, including dams and floodways.

Management of Amistad and Falcon Reservoirs

The IBWC accounts for flows from the named tributaries originating in Mexico and the U.S., as well as other flows entering the Rio Grande, in accordance with the provisions outlined in Appendix B (Schmandt). In jointly financing and constructing the Amistad and Falcon projects, the two nations agreed to the allocation of ***conservation storage capacity***, including ***sediment reserve***, noted in Table 4.

Table 4. Allocation of Conservation Storage Capacity Between the U.S. and Mexico.

Reservoir	Total Conservation Capacity (1,000 ac-ft)	United States	Mexico
Amistad	3,081	56.2%	43.8%
Falcon	2,635	58.6%	41.4%
Total	**5,716**	**57.3%**	**42.7%**

Source: Lower Rio Grande Development Council and U.S. Section, IBWC 2003.

The IBWC maintains a record of inflows, releases, evaporation volumes, and storage volumes allocated to each of the two countries. Releases to meet water needs in each country are charged against the appropriate country's allocation. The computed amount of water that each country has in storage is

known at all times, and the accounting is updated and reported daily, weekly, and monthly at various levels of detail.

Reservoir releases and storage levels are gauged. A network of evaporation pans located around the reservoirs provide estimates of evaporation rates, which are combined with reservoir surface areas determined from stage-area relationships to estimate evaporation volumes. Total inflows are determined from a volume balance. Flows from the tributaries named in the Treaty are gauged. The amount of storage allocated to each country is computed following the provisions of the Treaty.

Many ***gauging stations*** are located along the Rio Grande and its tributaries. The IBWC operates seventeen stream-gauging stations on the main-stream Rio Grande. The Mexican Section of the IBWC also operates eight gauging stations on tributaries in Mexico. The United Stations Section operates twelve gauging stations on its tributaries used in the water allocation, sixty-six other gauges on U.S. diversion and return flow channels, and thirteen gauging stations for flood warning and operation of the flood control storage in the Amistad and Falcon Reservoirs.

Chapter Summary

This chapter provided a brief overview of the water operations in the Lower Rio Grande Valley. Federal, state, and local institutions are involved in the allocation and distribution of inflows to the Rio Grande. On the federal level, the IBWC, which represents both the U.S. and Mexico, maintains records of inflows, releases and volumes of both the Falcon and Amistad reservoirs. The records are maintained for both sides of the border and are updated daily. The IBWC operates within the guidelines set forth in the 1944 Treaty between the U.S. and Mexico. On the State level, the TCEQ Rio Grande Watermaster maintains daily records of water accounts, as well as enforces compliance rules. The Watermaster serves as a direct link between the local irrigation districts and the IBWC. All irrigation districts' requests for water releases from Falcon Reservoir are made through the Watermaster's office. On the local level, irrigation districts provide water services to local cities, towns, industries, and farms. The Watermaster oversees the current water rights system for the irrigation districts, as discussed in Chapter 2.

Chapter 4
Emerging Issues

The Texas Lower Rio Grande Valley entered a period of rapid transition in the 1980s. Severe freezes in 1983 and 1989 destroyed thousands of acres of citrus. Many of these orchards were not re-planted, spurring a trend towards urbanization of agricultural land. The vagaries of weather, increased international trade, and the signing of the North American Free Trade Agreement (**NAFTA**) in the early 1990s launched economic development and rapidly increasing population for the region (Rocha).

Water issues have emerged as the primary resource problem for the region. Reliable and continued availability of this finite resource is an increasingly serious issue. The current situation in the Lower Rio Grande Valley simply reflects the same pressures being experienced in many regions. Discussed in this chapter are just a few of the key issues that are currently present in the Valley.

The first section discusses the rapid urban growth in the Lower Rio Grande Valley. This large increase in population has placed pressure on the local farmers in terms of urban sprawl and water availability. The second section briefly describes issues relating to the non-compliance of the 1944 Water Treaty between the U.S. and Mexico. As of October 2, 2002, Mexico officially defaulted on meeting the minimum annual average water requirements for the past two five-year cycles. This brings Mexico's total water debt to approximately 1.5 million ac-ft. The third section provides a brief evaluation of the economic impact that the non-compliance with the Treaty and a lingering drought has had on the Lower Rio Grande Valley. Mexico's non-compliance with the Water Treaty had major economic repercussions in the region, with estimates approaching $0.6 billion over the last ten years (J. Robinson). With the assistance of federal and state agencies, water infrastructure rehabilitation efforts are currently under way. These various agencies' involvement is discussed in the fourth section. Discussed in the fifth section are existing and proposed local water authorities.

Urban Growth

According to the 2000 U.S. Census Bureau data, the McAllen--Edinburg--Mission area is ranked fourth in the list of fastest-growing metropolitan areas in the United States (U.S. Census Bureau). With a 48.5 percent change in growth between 1990 and 2000, this area of the Lower Rio Grande Valley also ranked as the fastest growing metropolitan area in the State of Texas, exceeding the Austin--San Marcos area, which was ranked fifth nationwide with a 47.7 percent change (U.S. Census Bureau).

According to the 2001 report by the Rio Grande Regional Water Planning Group, the population of the Lower Rio Grande Valley is expected to more than double by the year 2050. With this anticipated population growth comes a projected increase in demand for municipal water from 253,000 ac-ft in 2000, to 506,000 ac-ft in 2050 (Rio Grande Regional Water Planning Group). Despite the increase in municipal demand, total water demand for the Valley is expected to decrease from 1,803,000 ac-ft in 2000, to 1,738,000 ac-ft in 2050 (Rio Grande Regional Water Planning Group). That is, the expected increase in demand for municipal and manufacturing water will be more than offset by the decrease in demand for irrigation water. Based on the population growth, the predicted increase of urban areas is a key reason for the decline in irrigated acreage and corresponding lessened demand for irrigation water.

Growth of urban areas and the associated loss of cropland, drought, and delivery shortfalls by Mexico have resulted in numerous leases and sales of water rights (Schmandt). Many of the sales have been from small irrigation water rights holders upstream to the major population centers. The vast majority of remaining irrigation rights lie with the twenty-nine irrigation districts in the lower portion of the Rio Grande Valley (see Figure 4). As ownership of limited water rights become more concentrated and demand for water increases, the price for water and value of water rights can be expected to rise.

Both cities and irrigation districts are seeking means of cooperation to fund capital rehabilitation projects. Such efforts are intended to enhance water conservation, strengthening the irrigation districts and their agricultural water users, as well as free up water for use by the growing urban population. Much of Texas' Senate Bill 1 for the region (Rio Grande Regional Water Planning Group) focused on these issues. As time progresses, cities can expect to gain water rights

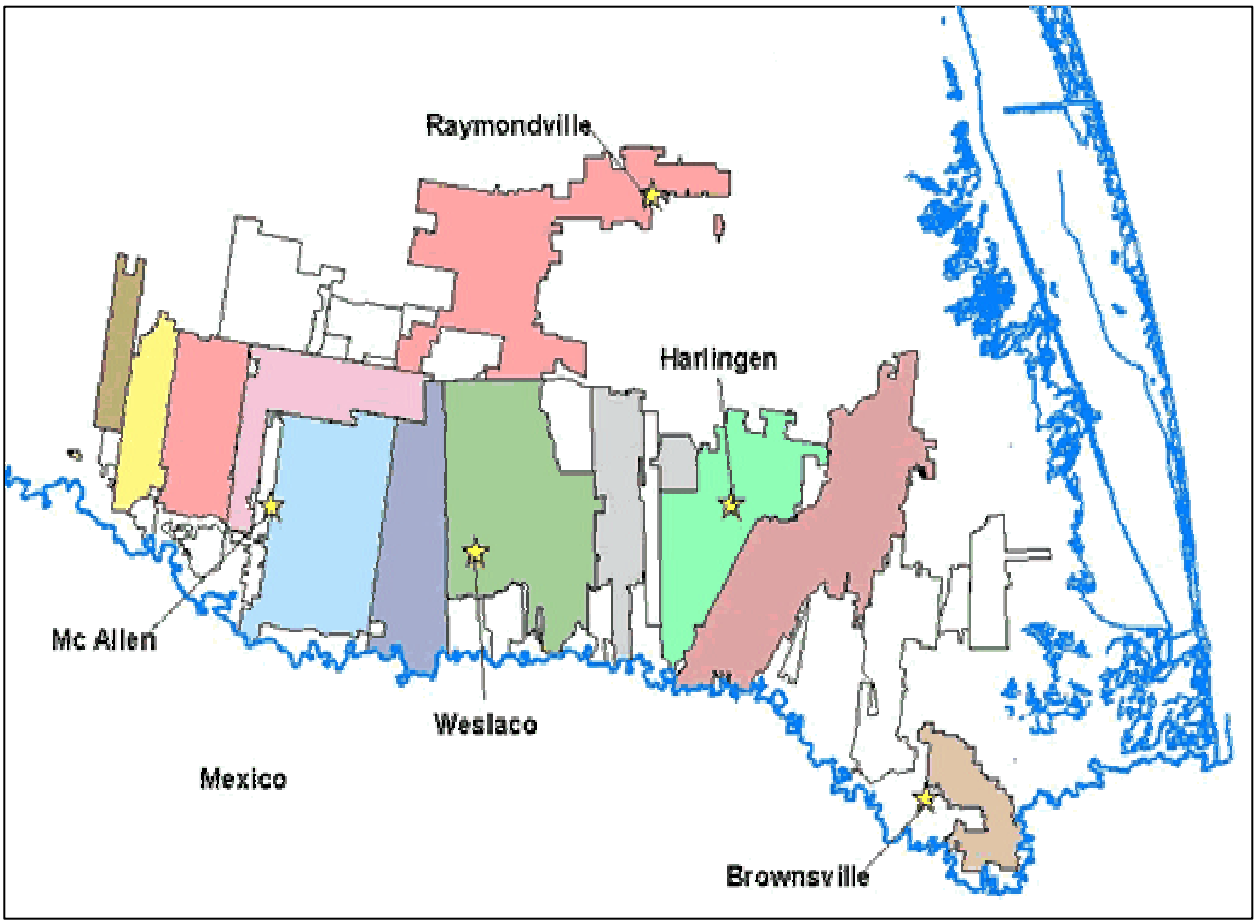

FIGURE 4. Graphic Illustration of Twenty-Nine Irrigation Districts in the Lower Rio Grande Valley.

Source: Fipps et al.

as agricultural land becomes urbanized, and the remaining irrigated farms will produce higher-value crops, which follows the patterns across much of the U.S.

Being it is the residual claimant on inflows to the reservoirs, irrigated agriculture use absorbs 100 percent of the drought risk in the system. Increases in the DMI reserve over time have exacerbated this effect. Recent adjustments to the new 75,000 ac-ft effective operational reserve level mitigate somewhat the immediate consequences of drought. Agricultural producers prefer to keep the operational reserve at its current level. Recent water shortages brought on by drought and limited deliveries by Mexico to the main stem of the Rio Grande have demonstrated how sensitive and dependent agriculture is to water restrictions (J. Robinson).

1944 Treaty Non-Compliance

According to the 1944 Treaty, Mexico agreed to provide an average minimum of 350,000 ac-ft per year to the U.S. from the Rio Conchos Basin and other small tributaries that feed into the Rio Grande. The U.S. agreed to deliver 1.5 million ac-ft per year to Mexico from the Colorado River in the western U.S. The U.S. is currently up to date on its obligations. Mexico has not delivered its obligation, however, for the past two five-year cycles. On October 2, 2002, Mexico officially defaulted, owing the U.S. more than 1.5 million ac-ft (Taylor 2002a). Drought within the State of Chihuahua is blamed for the default according to Mexican officials (Pinkerton).

The 1944 Treaty is between the U.S. and Mexico. Therefore, the State of Texas has no authority to force compliance as determined by TCEQ. Consequently, some lead stakeholders and state politicians have suggested the U.S. terminate the Treaty, or possibly withhold Colorado River water and cut economic aid to Mexico as a retaliatory measure (Taylor 2002a). Currently, talks between the U.S. and Mexico have not resolved the issue. Farmers on both sides of the Rio Grande are left with nothing except questions regarding the outcome of next season's crop, much less what the prospects are for the long-term viability of irrigated agriculture and related agribusiness infrastructure.

Economic Impact

Mexico's non-compliance with the 1944 Treaty, combined with a long-standing drought, has caused severe economic repercussions to both the Texas side of the Lower Rio Grande Valley and to its neighbors on the Mexican side. Mexico began its deficit with the U.S. during the 1992-1997 cycle with 1,024,000 ac-ft. By the next five-year cycle, which ended in October 2002, Mexico's debt increased to approximately 1.5 maf. Mexico's mounting water debt has caused an economic impact across the Valley touching all sectors.

Robinson used the "value-of-water approach" to determine the economic impact of irrigation water shortages caused by Mexico's non-compliance with the 1944 Treaty. He estimated an economic impact of 0.02 jobs and $652 in business activity per ac-ft of water applied at the ***farm gate***. Thus, Mexico's contribution of 350,000 minimum annual ac-ft of water as required by the 1944 Treaty contributes

4,130 jobs per year and a $135,000,000 in regional business activity per year.[10] The total accumulated water debt by Mexico is worth approximately $0.6 billion (J. Robinson).

Rehabilitation Efforts

Bureau of Reclamation

South Texas irrigation districts have an extensive system of engineered networks – including 24 major pumping stations and lifts, 800 miles of large water mains and canals, 1,700 miles of pipelines, and 700 miles of laterals that deliver water to agricultural fields and urban areas. Yet, many key components are more than 100 years old, outdated, and in need of repair.

Recognizing the seriousness of the water crisis in South Texas, Congress enacted Public Law 106-576, entitled "The Lower Rio Grande Valley Water Resources Conservation and Improvement Act of 2000 (Act)." In that Act, Congress authorized the Bureau of Reclamation (**BOR**) to undertake water conservation projects for irrigation districts relying on the Rio Grande River for supply of agricultural irrigation, and municipal and industrial water. Several phases of project planning, development, evaluation, prioritization, financing, and fund appropriation are necessary before these projects may be constructed. Public Law 106-576, the Lower Rio Grande Valley Water Resources Conservation and Improvement Act of 2000, included authorization of capital improvement projects for four irrigation districts relying on the Rio Grande River for its supply of Agricultural Irrigation and Municipal and Industrial water (United States Public Law 106-576). In 2002, another fifteen projects were authorized in the "Lower Rio Grande Valley Water Resources Conservation and Improvement Act of 2002" (H. R. 2990). These projects are listed in Tables C1 and D1 in appendices C and D, respectively. A brief project description of each project (as of May 2003) is included in Table C1 in Appendix C. Table D1 in Appendix D includes: an indication of federal authorization status, amount of **SECO** (State Energy Conservation Office) funding support, announced contingent **NADB** (North

[10] The job and dollar impacts incorporate the farm gate quantity of water shortages to be 41% losses from reservoir to the farm gate (i.e., a 350,000 ac-ft reservoir quantity equals a 206,500 ac-ft farm gate quantity). That is, the impact of Mexico's non-compliance is represented by farm-gate deliveries as opposed to water in the reservoir (J. Robinson).

American Development Bank, a binational development bank administered jointly by the U.S. and Mexico) Funding, and the estimated cost of each total project.

Among the potential capital improvement investments being considered by Rio Grande Basin irrigation districts are meters (for monitoring in-system flows and improving management of system operations); lining of existing open-delivery canals or installation of pipeline to replace open-delivery canals (to reduce leaks, improve flow rates, and increase head at diversion points); and pumping plant improvements. The BOR Guidelines for Public Law 106-576 (Bureau of Reclamation) specify three economic measures as among the information required for evaluation of the proposed projects:

- Number of ac-ft of water saved per dollar of Construction Costs;
- Number of BTU (i.e., British Thermal Units) of energy saved per dollar of Construction Costs; and
- Dollars of annual economic savings per dollar of initial Construction Costs.

Texas Agricultural Experiment Station and Texas Cooperative Extension economists and engineers are collaborating with Rio Grande Basin irrigation district managers, their consulting engineers, the BOR, and the Texas Water Development Board to perform economic and energy evaluations of the proposed projects.

Texas Agricultural Experiment Station and Texas Cooperative Extension economists have developed an Excel spreadsheet, RGIDECON© (Rio Grande Irrigation District Economics), to accommodate the calculation of these assessments (Rister et al.). The spreadsheet's calculations incorporate economic and financial principles consistent with capital budgeting procedures for evaluating projects of different economic lives. As a result, RGIDECON© is capable of providing valuable information for implementing a method(s) of prioritization of projects in the event of funding limitations. The Bureau of Reclamation, in a letter dated July 24, 2002 (Walkoviak), indicated that RGIDECON© satisfies the legislation authorizing projects and that the Bureau will use the results for economic and energy evaluation.

North American Development Bank

In June of 2002, an agreement was signed between the U.S. and Mexico regarding Mexico's non-compliance with the 1944 Water Treaty. This agreement

is referred to as Minute 308. Included in Minute 308 is the development of the Water Conservation Investment Fund (WCIF), which allocates $80 million of interest earnings on reserves from NADB. The total amount is to be used for the purposes of water conservation on both sides of the border, with $40 million going to the U.S. and $40 million to Mexico.

California, Arizona, and New Mexico are also eligible for the funding (Taylor 2002b). John Taylor, chairman of the NADB Board, said that "U.S. projects will be available to any entity - public or private - to construct any type of water conservation project — agricultural or non-agricultural-related - within 100 kilometers of the border."

As a result of this new potential funding source, the Texas Agricultural Experiment Station, Texas Cooperative Extension, and the Texas Water Development Board are working with the Rio Grande Valley irrigation district mangers, participating engineers, **BECC** (Border Environment Cooperation Commission), and NADB to create supporting evidence for water conservation and improvement projects within the Rio Grande Basin irrigation districts. These efforts could supplement many projects already authorized for Federal assistance of capital renovations through a program authorized by Congress and under the administration of the BOR (U.S. Public Law 016-576, as amended). Subsequently, discussions with the NADB and BECC management indicate analyses prepared for the BOR are adequate and acceptable for documenting the sustainability aspects of the irrigation districts' Stage 1 and 2 submissions required by BECC and the NADB.

New guidelines regarding the NADB funding were released on February 10, 2003. Irrigation districts with approved grants will receive no more than $4 million per project and may not exceed 50% of the project cost. As stated in these guidelines, projects must reduce water loss or consumption in order to be eligible for funding (North American Development Bank). Expected NADB projects are presented in Table D1.

Texas Water Development Board

The Texas Water Development Board (**TWDB**) is charged with water planning in Texas. This State agency has supported water studies for the Lower Rio Grande Valley over a number of years, including regional analysis coordinated by the Lower Rio Grande Valley Development Council. This analysis provided a strong foundation for the regional water plan conducted under Senate

Bill 1 (legislation that formed 16 regions in Texas to take water planning to the local level). The regional water plan for this part of Texas brought the seriousness of water issues clearly into focus.

The Texas Water Development Board is serving to facilitate the efforts for infrastructure renovation by the BOR and NADB through the SECO program. This provides a source of funds administered by the TWDB to support engineering studies of proposed projects. These engineering analyses are critical components for irrigation districts in defining characteristics of projects, investment, and water and energy conservation potential. The TWDB contracts with irrigation districts for the engineering dimension of proposed projects and typically irrigation districts subcontract with a consulting engineer or the BOR. Coordination across the TWDB, BOR, NADB, Texas Agricultural Experiment Station/Texas Cooperative Extension, irrigation district managers, and consulting engineers brings consistency across all projects.

Water Authorities

Throughout Texas, river authorities play major roles in developing and managing regional water resources . . . that is, except along the Rio Grande. Here, no general-purpose institution has wielded broad management authority or functioned as a sponsoring agency for large-scale projects that provide water and wastewater utility services, improve and operate irrigation conveyance and distribution systems, generate electric power, or develop and operate recreational facilities.

All that is about to change. Due in part to discussions generated through the long-range regional water planning process, water users in the Lower Valley are turning to the concept of the water authority as an efficient and economical means of developing water resources and financing regional projects.

Previously Established Authorities

Some 21 irrigation districts covering more than a half-million acres in Hidalgo, Cameron, and Willacy counties have revived the dormant Lower Rio Grande Authority (**LRGA**), established by the Texas Legislature in 1952. Since February 2003, the districts have elected officers, established four working committees, and levied an assessment of 10 cents per acre on members as seed money to jump-start efforts to begin planning and attract financing for large-scale

regional projects. The LRGA's powers, says LRGA Secretary-Treasurer Joe Barrera, allow for a wide range of projects, from desalination and drainage to electric power and funds administration.

Although the authority's enabling legislation currently does not extend membership to entities other than irrigation districts, committees are open to representatives of municipalities and other interested parties. Regular meetings are scheduled for the first Thursday of every month at the offices of the Donna Irrigation District, 101 North FM 493. Meetings start at 9 am.[11]

The Southmost Regional Water Authority, formed in 1981, was resurrected in 2000 to explore the possibilities of using brackish ground water as an alternative water supply. Members include the Brownsville Public Utility Board, Valley Municipal Utility District No. 2 (Rancho Viejo), City of Los Fresnos, Town of Indian Lake, Port of Brownsville, and Laguna Madre Water District. In December 2002, the Authority broke ground on a reverse osmosis plant that will provide 7.5 million gallons per day of high quality drinking water. **NRS** (Norris, Rice, and Stone) Consulting Engineers is designing and managing the project. Completion is slated for late summer 2003 (NRS Consulting Engineers).

New and Proposed Authorities

In addition, the 78th Legislature enacted two bills establishing new regional authorities. Senate Bill (**SB**) 1902, authored by State Senator Eddie Lucio (Brownsville), will create the Rio Grande Regional Water Authority to pursue a variety of projects in Cameron, Willacy, Hidalgo, Starr, Zapata, and Webb counties (excluding Laredo). Effective Sept. 1, 2003, the Authority will be able to coordinate, fund, construct, and provide water supply and wastewater treatment services; coordinate, fund, and construct agricultural conservation projects; help obtain and coordinate state and federal grant and loan funds; and issue bonds. The Authority may not levy taxes nor condemn water rights.

The Authority will be governed by an appointed Board of Directors representing all interest groups throughout the area served, including irrigation districts, the public, water utilities, and municipalities.[12] SB 721, also by Sen. Lucio, creates the Cameron-Hidalgo-Willacy Regional Water Authority. The authority includes all

[11] For further information, contact Barrera at (956) 831-8462.

[12] For further information, contact Bill Summers, President and CEO of the Rio Grande Valley Partnership, (956) 968-3141.

the territory located in the service area of five water supply corporations (**WSC**): Olmito WSC, East Rio Hondo WSC, Military Highway WSC, North Alamo WSC, and Arroyo WSC. Brian Macmanus, Director of Water and Wastewater for East Rio Hondo WSC, explains that through the Authority, partners can achieve economies of scale while significantly reducing their dependence on surface water. The first project planned is a regional reverse osmosis facility that will treat brackish groundwater. Macmanus says the plant will be designed to produce 2 to 3 million gallons of drinking water per day.

In addition, several municipalities and water supply corporations have recently established not-for-profit, "local government corporations" as a low-risk vehicle for developing regional water projects. Local entities can empower a corporation to act on their behalf and pursue interlocal agreements, but do not incur any the corporation's debt or liability. Corporations do not have any taxing power.

Texas law has specifically allowed local government corporations since the early 1990s. Now, water entities in Cameron and Willacy counties have set up the first such corporations in the Rio Grande Valley. North Alamo WSC, East Rio Hondo WSC, and the City of Primera have created the North Cameron Regional Water Authority. The group has been invited to apply for financing through the State Drinking Water Revolving Fund. In addition, North Alamo WSC worked with the cities of Raymondville, Lyford, Port Mansfield, and San Perlita to create the Willacy County Regional Water Authority.

Conclusion

Many of the issues facing the Lower Rio Grande Valley today have their origins based in the long and detailed history of settlement, development, and water rights. Complexities within operating procedures are due to previous legal rulings and court decisions. This report illustrates the history of settlement and development of the Rio Grande Basin and how those activities played a key role in shaping current water rights and laws, how the waters of the Rio Grande are divided between the two nations, how the U.S. and the State of Texas manage their portions, and finally discusses many of the relevant contemporary issues in the Lower Rio Grande Valley. This report was developed to provide an overview of the situation, institutions, and factors affecting water in the Lower Rio Grande Valley. The objective was to provide insight and understanding to stakeholders, decision makers, legislators, federal and state agencies, and university scientists.

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Glossary[13]

Acre-feet: a measure of water contained in an area of one acre square and one foot deep (equal to 325,851 gallons).

Adjudicate: the giving or announcement of judgment in a cause.

Ad Valorem: Latin for "based on value," which applies to property taxes based on a percentage of the county's assessment of the property's value.

Annual Diversion Amount: the taking of water from a stream or other body of water into a canal, pipe, or other conduit that is measured yearly.

Conservation Storage Capacity: storage of water for later release for usual purposes such as municipal water supply, power, or irrigation in contrast with storage capacity used for flood control.

Dead Storage: the volume in a reservoir below the lowest controllable level.

DMI (Domestic, Municipal, and Industrial) Reserve: 225,000 ac-ft of water that is reserved at the beginning of allocation by the Watermaster for Domestic, Municipal, and Industrial uses.

Dual System: the appropriations system that allowed both a riparian system and state-licensing system simultaneously.

English Common Law: adopted by the Texas legislature in 1840. With the Common Law system came the English riparian doctrine (or English water law), allowing landowners to reasonably use water for irrigation and other purposes (Templer).

[13] All first mentioned ***bold, italicized*** terms in text are defined in the Glossary.

Eminent Domain: the power of a governmental entity (e.g., federal, state, county or city government or other agencies) to take private real estate for public use, with or without the permission of the owner.

Farm gate: the point at which water reaches the actual farm or final location. This value ignores (i.e., does not include) the evaporation and seepage loss incurred as water travels from the reservoir.

Floodway: the part of a dam design to control the rate at which water is discharged.

Gauging Station: a particular site on a stream, canal, lake, or reservoir where systematic observations of stage or stream flow are obtained.

Levee: an embankment raised to prevent a river from overflowing.

No-Charge Pumping: no-charge water can be pumped from the Rio Grande but not deducted from the allottee's surface water account. Note: no-charge water is the excess flow of water.

Operating Reserve: 75,000 acre feet of water that is accounted for to cover losses in the United States portion. Losses include seepage, evaporation, and conveyance; emergency requirements; and adjustments made by the IBWC.

Reach: the distance water flows in one day.

Riparian Water Rights: the right of the owner of the land forming the bank of a river or stream to use water from the waterway on the land, such as for drinking water or irrigation.

Run-off: the flow resulting from precipitation events.

Sediment Reserve: a volume included in the design of a reservoir that accounts for sediment accumulation.

The Valley: the common reference to the Lower Rio Grande Valley; comprised of Cameron, Hidalgo, Starr, and Willacy counties in the southern tip of the State of Texas.

Usable Storage: the total water storage in Falcon and Amistad reservoirs (as reported by the IBWC), minus the amount of dead storage.

Watermaster: official for the Texas Commission on Environmental Quality's jurisdiction; is responsible for the day-to-day compliance and day-to-day accounting of water rights (Houston Advanced Research Center & Instituto Tecnilogico de Estudios Sueriores de Monterrey)

Water Year: a water year ends on the last Saturday of the year at midnight. This does not always fall on January 1.

Weir: an obstruction placed in a channel so that the flow is constricted as it goes over a crest. Used to decrease the flow rate.

List of Acronyms[14]

Ac-ft: acre-feet

BECC: Border Environment Cooperation Commission

BOR: Bureau of Reclamation

BWE: Board of Water Engineers

DMI: Domestic, Municipal, and Industrial

IBWC: International Boundary and Water Commission

ID: Irrigation District

LRGA: Lower Rio Grande Authority

MAF: Million Acre-Feet

M&I: Municipal & Industrial

NADB: North American Development Bank

NAFTA: North American Free Trade Agreement

NRS: Norris, Rice, and Stone

RGB: Rio Grande Basin

SB: Senate Bill

SECO: State Energy Conservation Office

SLB&M: St. Louis, Brownsville, and Mexico Railroad

Sq. mile: Square mile

TCEQ: Texas Commission on Environmental Quality

[14] All first mentioned acronyms in the text are printed in **bold** and listed in the "List of Acronyms."

U.S.: United States of America

WCID: Water Control and Improvement District

WID: Water Improvement District

WSC: Water Supply Corporations

Appendices

Appendix A

Table A1. Lower Rio Grande Irrigation District Storage Balances (March 2000 – March 2003).

District	Authorized Water Right	March 2000 Storage Balance	March 2001 Storage Balance	March 2002 Storage Balance	March 2003 Storage Balance	Month to Date Difference between Mar '02 and Mar '03	Percentage Difference between Mar '02 and Mar '03
	ac-ft						
Adams Gardens	18,737.65	7,600.21	7,917.94	7,464.21	**9,420.44**	1,956.23	26.21%
Bayview	17,478.02	6,055.11	9,733.06	5,567.00	**8,935.37**	3,368.38	60.51%
Brownsville	33,949.45	22,477.10	27,051.90	23,065.71	**23,044.58**	-21.13	-0.09%
Delta Lake	174,776.37	96,687.99	106,753.89	72,711.48	**89,955.86**	17,244.38	23.72%
Donna	94,063.60	48,701.67	63,881.55	44,655.65	**52,953.78**	8,298.13	18.58%
Edinburg #1	85,615.00	66,885.76	70,381.63	45,285.22	**52,834.05**	7,548.83	16.67%
Engleman	20,031.30	9,530.02	14,355.91	12,354.93	**15,348.59**	2,993.66	24.23%
Harlingen	97,573.60	41,348.93	46,260.56	36,062.54	**52,065.55**	16,003.01	44.38%
HCID #13	4,856.85	2,940.64	3,751.25	3,908.83	**3,351.24**	-557.58	-14.26%
HCID #5	14,234.62	7,921.85	11,151.76	7,555.08	**7,468.38**	-86.70	-1.15%
HCID #6	34,913.00	22,467.15	29,085.25	22,353.79	**26,136.04**	3,782.26	16.92%
HCWC&ID #18	5,505.15	738.98	2,022.51	2,324.43	**3,590.47**	1,266.04	54.47%
La Feria #3	75,625.92	20,789.20	24,722.60	17,278.82	**33,203.92**	15,925.10	92.17%
Los Fresnos	52,141.92	17,084.00	15,879.91	20,059.45	**30,677.93**	10,618.48	52.94%
McAllen #3	9,752.60	8,059.17	6,489.58	5,840.69	**5,345.46**	-495.23	-8.48%
Mercedes #9	177,151.62	54,060.62	69,299.94	44,121.51	**74,658.02**	30,536.51	69.21%
Mission #16	21,162.40	16,336.04	18,853.90	15,152.47	**17,374.57**	2,222.10	14.66%
Mission #19	11,776.65	612.77	3,705.10	1,877.25	**4,204.64**	2,327.39	123.98%
San Benito	147,823.65	47,314.20	61,554.98	44,330.42	**66,392.74**	22,062.31	49.77%
San Juan #2	137,675.00	99,060.19	111,220.98	90,214.64	**94,617.81**	4,403.16	4.88%
Santa Cruz #15	77,180.00	46,749.96	56,188.83	49,456.90	**59,154.54**	9,697.64	19.61%
Santa Maria #4	10,182.50	3,968.27	4,107.09	2,924.56	**4,755.09**	1,830.54	62.59%
United	64,463.52	40,494.82	56,293.51	36,827.02	**39,482.57**	2,655.56	7.21%
Valley Acres	16,124.25	8,905.77	9,839.80	3,659.58	**6,957.02**	3,297.45	90.10%
Totals	**1,402,794.68**	**696,790.39**	**830,503.42**	**615,052.16**	**781,928.67**	**166,876.51**	**27.13%**

Source: Rubinstein 2003.

Appendix B

The following is a verbatim reproduction of Articles 4 and 8 of "U.S.-Mexico Treaty for Utilization of the Waters of the Colorado and Tijuana Rivers and of the Rio Grande," a treaty between the United States of America and Republic of Mexico, also referred to as the 1944 International Water Treaty (U.S.-Mexico Treaty for Utilization of the Waters of the Colorado and Tijuana Rivers and of the Rio Grande).

Articles 4 and 8 of the 1944 International Water Treaty

II Rio Grande (Rio Bravo)

Article 4

The waters of the Rio Grande (Rio Bravo) between Fort Quitman, Texas and the Gulf of Mexico are hereby allotted to the two countries in the following manner:

A. To Mexico:

(a) All of the waters reaching the main channel of the Rio Grande (Rio Bravo) from the San Juan and Alamo Rivers including the return flow from the lands irrigated from the latter two rivers.

(b) One-half of the flow in the main channel of the Rio Grande (Rio Bravo) below the lowest major international storage dam, so far as said flow is not specifically allotted under this Treaty to either of the two countries.

(c) Two-thirds of the flow reaching the main channel of the Rio Grande (Rio Bravo) from the Conchos, San Diego, San Rodrigo, Escondido and Salado Rivers and the Las Vacas Arroyo, subject to the provisions of subparagraph (c) of paragraph B of this Article.

(d) One-half of all other flows not otherwise allotted by this Article occurring in the main channel of the Rio Grande (Rio Bravo), including the contributions from all the unmeasured tributaries, which are those not named in this Article, between Fort Quitman and the lowest major international storage dam.

B. To the United States:

(a) All of the waters reaching the main channel of the Rio Grande (Rio Bravo) from the Pecos and Devils Rivers, Goodenough Spring, and Alamito, Terlingua, San Felipe and Pinto Creeks.

(b) One-half of the flow in the main channel of the Rio Grande (Rio Bravo) below the lowest major international storage dam, so far as said flow is not specifically allotted under this Treaty to either of the two countries.

(c) One-third of the flow reaching the main channel of the Rio Grande (Rio Bravo) from the Conchos, San Diego, San Rodrigo, Escondido and Salado Rivers and the Las Vacas Arroyo, provided that this third shall not be less as an average amount in cycles of five consecutive years, than 350,000 acre-feet (431,721,000 cubic meters) annually. The United States shall not acquire any right by the use of the waters of the tributaries named in this subparagraph, in excess of the said 350,000 acre-feet (431,721,000 cubic meters)

annually, except the right to use one-third of the flow reaching the Rio Grande (Rio Bravo) from said tributaries, although such one-third may be in excess of that amount.

(d) One-half of all other flows not otherwise allotted by this Article occurring in the main channel of the Rio Grande (Rio Bravo), including the contributions from all the unmeasured tributaries, which are those not named in this Article, between Fort Quitman and the lowest major international storage dam.

In the event of extraordinary drought or serious accident to the hydraulic systems on the measured Mexican tributaries, making it difficult for Mexico to make available the run-off of 350,000 acre-feet (431,721,000 cubic meters) annually, allotted in subparagraph (c) of paragraph B of this Article to the United States as the minimum contribution from the aforesaid Mexican tributaries, and deficiencies existing at the end of the aforesaid five-year cycle shall be made up in the following five-year cycle with water from the said measured tributaries.

Whenever the conservation capacities assigned to the United States in at least two of the major international reservoirs, including the highest major reservoir, are filled with waters belonging to the United States, a cycle of five years shall be considered as terminated and all debits fully paid, whereupon a new five-year cycle shall commence.

Article 8

The two Governments recognize that both countries have a common interest in the conservation and storage of waters in the international reservoirs and in the maximum use of these structures for the purpose of obtaining the most beneficial, regular, and constant use of the waters belonging to them. Accordingly, within the year following the placing in operation of the first of the major international storage dams which is constructed, the Commission shall submit to each Government for its approval, regulations for the storage, conveyance and delivery of the waters of the Rio Grande (Rio Bravo) from Fort Quitman, Texas to the Gulf of Mexico. Such regulations may be modified, amended or supplemented when necessary by the Commission, subject to the approval of the two Governments. The following general rules shall severally govern until modified or amended by agreement of the Commission, with the approval of the two Governments:

(a) Storage in all major international reservoirs above the lowest shall be maintained at the maximum possible water level, consistent with flood control, irrigation use and power requirements.

(b) Inflows to each reservoir shall be credited to each country in accordance with the ownership of such inflows.

(c) In any reservoir the ownership of water belonging to the country whose conservation capacity therein is filled, and in excess of that needed to keep it filled, shall pass to the other country may have unfilled conservation capacity, except that one country may at its option temporarily use the conservation capacity of the other country not currently being used in any of the upper reservoirs; provided that in the event of flood discharge or spill occurring while one country is using the conservation capacity of the other, all of such flood discharge or spill shall be charged to the country using the other's capacity, and all inflow shall be credited to the other country until the flood discharge

or spill ceases or until the capacity of the other country becomes filled with its own water.

(d) Reservoir losses shall be charged in proportion to the ownership of water in storage. Releases from any reservoir shall be charged to the country requesting them, except that releases for the generation of electrical energy, or other common purpose, shall be charged in proportion to the ownership of water in storage.

(e) Flood discharges and spills from the upper reservoirs shall be divided in the same proportion as the ownership of the inflows occurring at the time of such flood discharges and spills, except as provided in subparagraph (c) of this Article. Flood discharges and spills from the lowest reservoir shall be divided equally, except that one country, with the consent of the Commission, may use such part of the share of the other country as is not used by the latter country.

(f) Either of the two countries may avail itself, whenever it so desires, of any water belonging to it and stored in the international reservoirs, provided that the water so taken is for direct beneficial use or for storage in other reservoir. For this purpose the Commissioner of the respective country shall give appropriate notice to the Commission, which shall prescribe the proper measures for the opportune furnishing of the water.

Appendix C

Table C1. Texas Rio Grande Basin Irrigation Districts' Proposed Capital Rehabilitation Project Components (2000 – 2003).

Irrigation District and Location	Proposed Project Components
Adams Garden Irr. Dist. #19 *Harlingen*	(1) purchase and install the re-enforced concrete, fiberglass, or PVC pressure pipe; (2) install flow and water level measurement instruments and a telemetry system; and (3) Interconnect the District's and Harlingen Irrigation District Cameron Co.# 1's water delivery systems.
Bayview Irr. Dist. #11 *Los Fresnos*	(1) rebuild unit 1 and unit 1-13 canals.
Brownsville Irr. Dist. *Brownsville*	(1) install 6,000' + of 72" pipe replacing main delivery canal (from Rio Grande diversion point to resaca, and from resaca in two canals).
Cameron Co. Irr. Dist. #1 *Harlingen*	(1) install 105 canal meters at 70 locations, and telemetry equipment; (2) install 3.26 miles of impervious lining in concrete-lined canal; (3) install 5.66 miles of 24" pipe to replace concrete-lined canal; and (4) install 400 on-farm delivery-site meters.
Cameron Co. Irr. Dist #2 *San Benito*	(1) construct interconnect between Canals 39 and 13-A1; and (2) pumping plant replacement at Rio Grande diversion point.
Cameron Co. Irr. Dist. #2 *San Benito*	(1) lining of canals B, C, and D; (2) canal B laterals; (3) canal C laterals; (4) lining of old district 13 canals; and (5) old district 13 pipelines.
Cameron Co. Irr. Dist. #6 *Los Fresnos*	(1) replacement of pumping plant (approximately 6 pumps total).

Table C1, continued.

Irrigation District and Location	Project Components
Cameron Co. #10 Rutherford-Harding	(1) dredge and line canals; and (2) replacement of pump.
Delta Lake Irr. Dist. *Edcouch*	(1) Reservoir Renovation: dig a by-pass canal.; (2) Main Canal Seepage Recovery: pump seepage water; (3) Flow Measure and Telemetry: install meters in main canals; and (4) Pipeline and Canal Lining: renovate/replace canal with PVC or RCP.
Donna Irr. Dist. *Donna*	(1) install unspecified pipeline to replace laterals.; and (2) install control system upgrade of the relift pump station.
El Paso *El Paso*	(1) install pipeline.
Engleman Irr. Dist. *Elsa*	(1) Reclaim Pump Station: install pump to capture "spilled" water; (2) Interconnect with Mercedes: install 1,200 feet of 48" pipe; (3) Reservoir Project: seal 60-acre reservoir with bentonite; and (4) Pipeline Replacement: replace unspecified pipelines.
Hidalgo Co. Irr. Dist. #1 *Edinburg*	(1) install 5,900' of mostly 72" pipe to replace concrete-lined canal; and (2) install 28,600 of multi-size pipe to replace concrete-lined canal.
Hidalgo Co. Irr. Dist. #2 *San Juan*	(1) Wisconsin: install 2+ miles of 48" pipe replacing open lateral.
Hidalgo Co. Irr. Dist. #2 *San Juan*	(1) Lateral A: install 7.25 miles of lining open lateral.
Hidalgo Co. Irr. Dist. #2 *San Juan*	(1-7) seven projects, all dealing with placing canals in pipelines, relining canals, and replacing mortar-joint pipelines with either RCP or plastic pipe.

Table C1, continued.

Irrigation District and Location	Project Components
Hidalgo County Irr. Dist. #5 *Progreso*	(1) replacing old pipeline with new; (2) dredging reservoirs; (3) upgrading meters; (4) drilling under ground wells to supplement supply; and (5) purchase more land for reservoirs.
Hidalgo Irr. Dist. #6 *Mission*	(1) reline 10.2 miles of concrete-lined canal with synthetic lining or concrete with a fiberglass add-mixture; and (2) replace main-canal slide gate with radial gate bays and install equipment for remote reporting of gate settings and water levels.
Hidalgo Irr. Dist. #16 *Mission*	(1) pumping plant upgrade to variable speed pumps that are controlled by flow meters strategically placed down-stream in the District's canal/lateral delivery system.
Hidalgo/Cameron Co. Irr. Dist. #9 *Mercedes*	(1) install 6 automatic control gates at 3 canal control stations.
Hudspeth #1 *Fr. Hancock*	(1) construct Alamo Arroyo pumping plant (mix water); and (2) construct a 1,000 ac-ft reservoir.
La Feria Irr. Dist. #3 *La Feria*	(1) install 3,700' of 24" pipe; and (2) install 24,816' of 30" pipe.
Maverick Co. WCID #1 *Eagle Pass*	(1) line 12 miles of main canal with urethane or concrete lining.
United Irr. Dist. *Mission*	(1) rehabilitate 3 relift stations; (2) improve main canal levee; and (3) install 20+ miles of canal with unspecified pipe.
Valley Acres Irr. Dist. *Santa Rosa*	(1) reline canals.

Table C1, continued.

Irrigation District and Location	Project Components
Valley Municipal Utility Dist. *Mission*	(1) improvements to supply canal (NADB May 2003).

Sources: Walker; Sundermann.

Appendix D

Table D1. Texas Rio Grande Basin Irrigation Districts' Proposed Capital Rehabilitation Projects' Authorization, Funding Status, and Estimated Cost (2000 – 2003).

Irrigation District and Location	Legislatively Authorized[a]	Proposal Preparation SECO Funded[b]	Contingent NADB Funding Granted May 16, 2003[c]	Estimated Cost
Adams Garden Irr. Dist. #19 *Harlingen*	No	No	sought but not granted	$2,910,000
Bayview Irr. Dist. #11 *Los Fresnos*	No	No	$637,548	$2,000,000
Brownsville Irr. Dist. *Brownsville*	107-351 (2002)	$205,000 12/12/2002	$1,178,000	$2,356,000
Cameron Co. Irr. Dist. #1 *Harlingen*	106-576 (2000)	$178,030 1/30/2002	$1,780,000	$3,209,999
Cameron Co. Irr. Dist. #2 *San Benito*	106-576 (2000) & 107-351 (2002)	$527,324 1/30/2002	$1,800,000 $4,000,000	$13,300,300
Cameron Co. Irr. Dist. #2 *San Benito*	107-351 (2002)	No	not sought	$15,650,000
Cameron Co. Irr. Dist. #6 *Los Fresnos*	No	No	sought but not granted	$2,000,000

Table D1, continued.

Irrigation District and Location	Legislatively Authorized[a]	Proposal Preparation SECO Funded[b]	Contingent NADB Funding Granted May 16, 2003[c]	Estimated Cost
Cameron Co. #10 *Rutherford-Harding*	No	No	not sought	$2,000,000
Delta Lake Irr. Dist. *Edcouch*	107-351 (2002)	$253,020 12/4/2002	$3,560,000	$7,120,000
Donna Irr. Dist. *Donna*	107-351 (2002)	$329,816 11/7/2002	$3,000,000	$4,000,000
El Paso *El Paso*	107-351 (2002)	$202,181 10/11/2002	not sought	$5,712,890
Engleman Irr. Dist. *Elsa*	No	No	sought but not granted	$950,000
Hidalgo Co. Irr. Dist. #1 *Edinburg*	106-576 (2000) & 107-351 (2002)	$380,512 12/2/2002 & 3/4/2002	$2,887,500	$5,012,724
Hidalgo Co. Irr. Dist. #2 *San Juan*	107-351 (2002)	$212,398 12/12/2002	$600,000	$1,580,300
Hidalgo Co. Irr. Dist. #2 *San Juan*	107-351 (2002)	$212,398 12/12/2002	$586,383	$3,154,200

Table D1, continued.

Irrigation District and Location	Legislatively Authorized[a]	Proposal Preparation SECO Funded[b]	Contingent NADB Funding Granted May 16, 2003[c]	Estimated Cost
Hidalgo Co. Irr. Dist. #2 *San Juan*	No	No	sought but not granted	$3,330,533
Hidalgo County Irr. Dist. #5 *Progreso*	No	No	sought but not granted	$13, 700,000
Hidalgo Irr. Dist. #6 *Mission*	107-351 (2002)	$153,060 12/12/2002	$1,500,000	$3,000,000
Hidalgo Irr. Dist. #16 *Mission*	107-351 (2002)	$271,180 3/10/2003	$1, 376,697	$4,000,000
Hidalgo/Cameron Co. Irr. Dist. #9 *Mercedes*	107-351 (2002)	$88,230 12/4/2002	$1,250,000	$800,000
Hudspeth #1 *Fr. Hancock*	107-351 (2002)	$143,560 1/13/2003	not sought	$3,250,000
La Feria Irr. Dist. #3 *La Feria*	106-576 (2000)	$133,070 4/16/2002	sought but not granted	$4,186,200
Maverick Co. WCID #1 *Eagle Pass*	107-351 (2002)	$308,882 12/4/2002	$406,941	$9,600,000
United Irr. Dist. *Mission*	107-351 (2002)	$159,260	sought but not granted	$8,151,381

Table D1, continued.

Irrigation District and Location	Legislatively Authorized[a]	Proposal Preparation SECO Funded[b]	Contingent NADB Funding Granted May 16, 2003[c]	Estimated Cost
Valley Acres Irr. Dist. *Santa Rosa*	No	No	sought but not granted	$610,000
Valley Municipal Utility Dist. *Mission*	No	No	$1,097,729	$2,500,000

Sources: U.S. Public Law 106-576; H.R. 2990; North American Development Bank; Walker; and Sundermann.

[a] U.S. Public Law and Year of Authorization.

[b] Amount of funding and date contract executed.

[c] Funding is contingent upon certification by the BECC and the NADB Board's approval of specific financing proposals" (North American Development Bank).

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